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Architecture 100

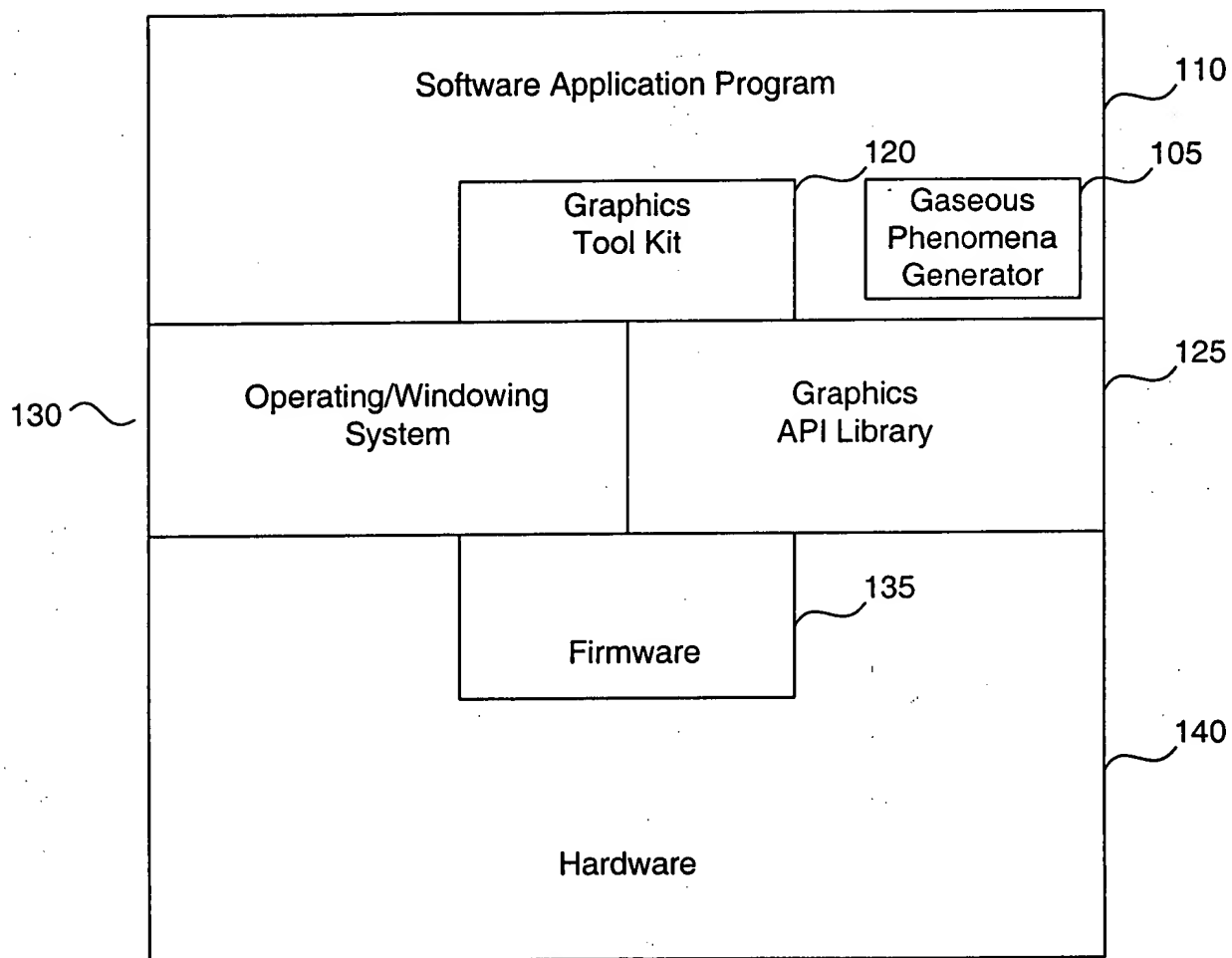


FIG. 1



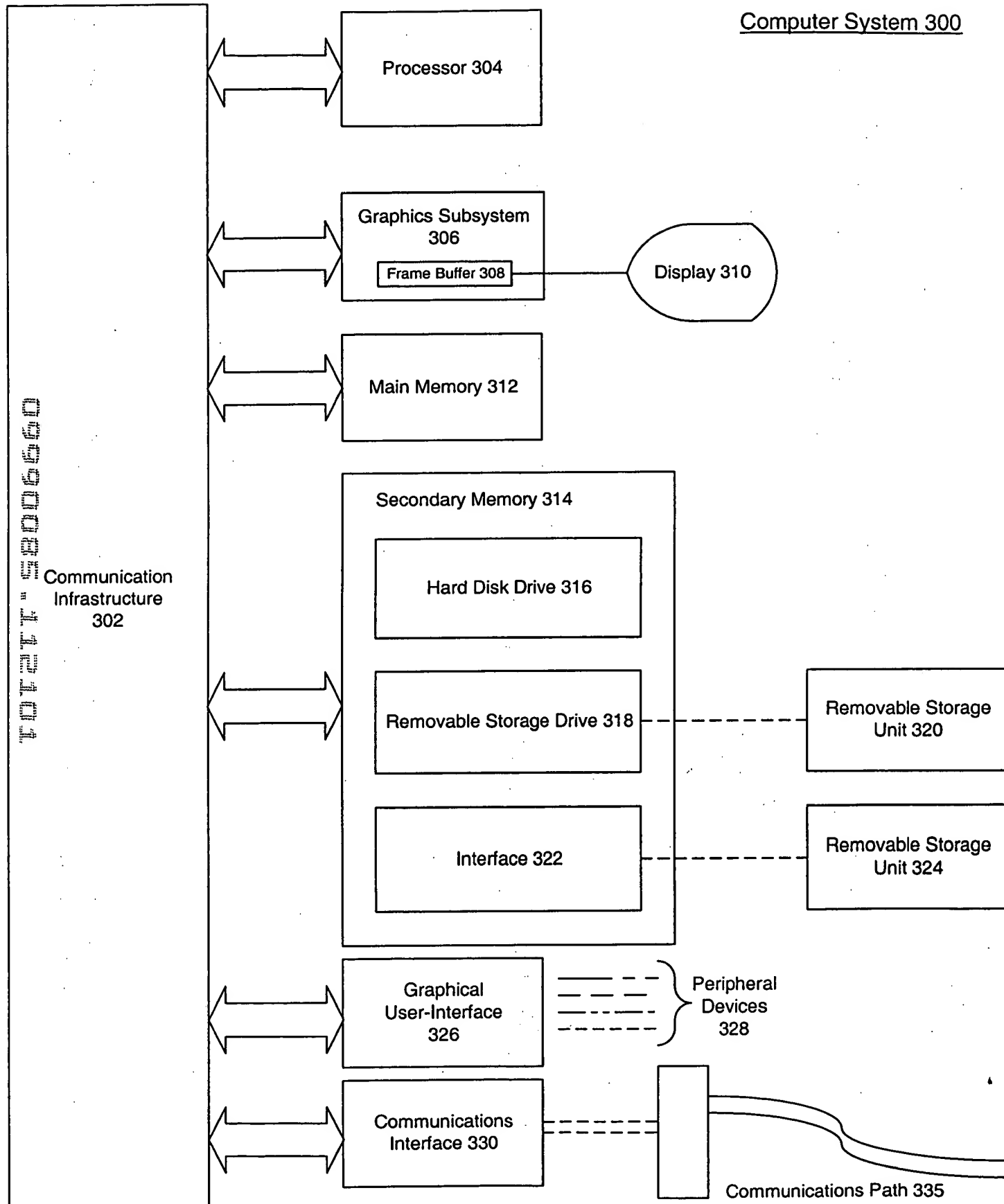


FIG. 3

**Routine For Rendering Volumetric Fog
or Other Gaseous Phenomena**

400

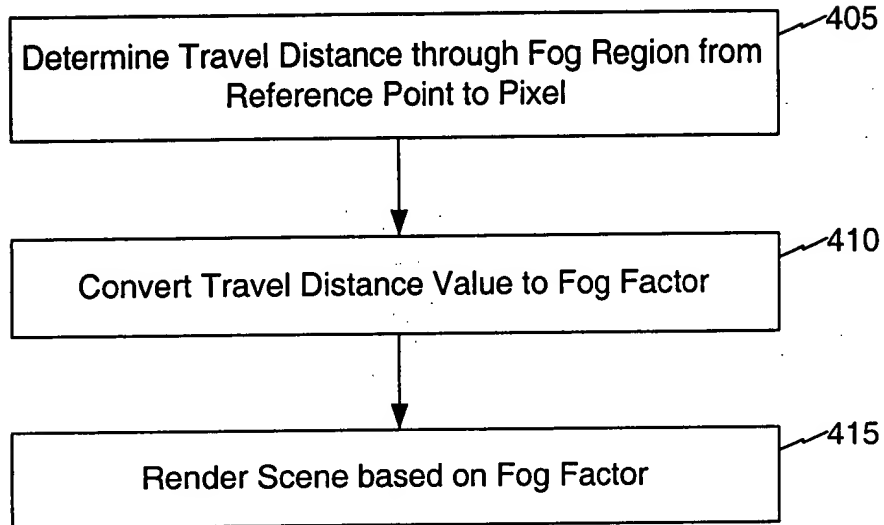


FIG. 4

09990085.1.2.401

**Determine Travel Distance through Fog Region
from Reference Point to Pixel**

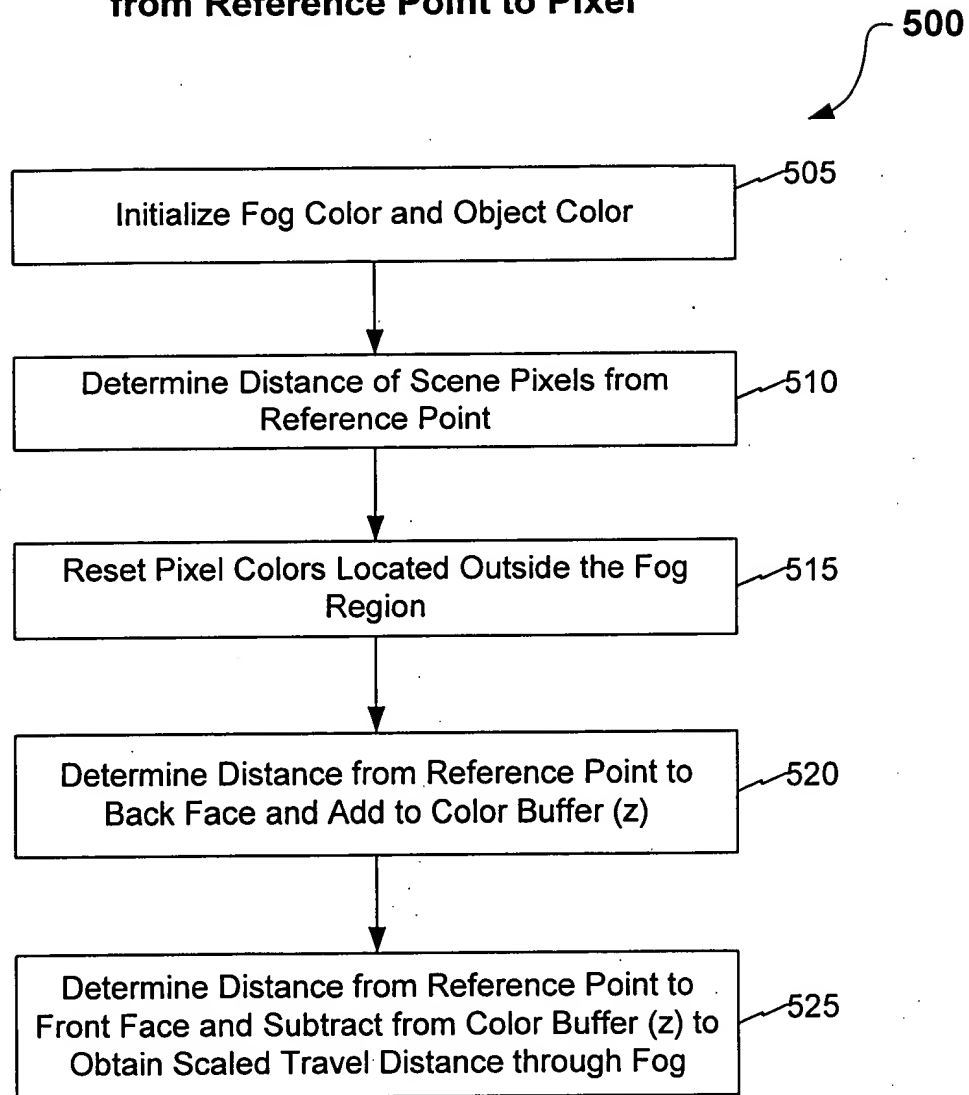


FIG. 5

**Determine Distance of Scene Pixels From
Reference Point**

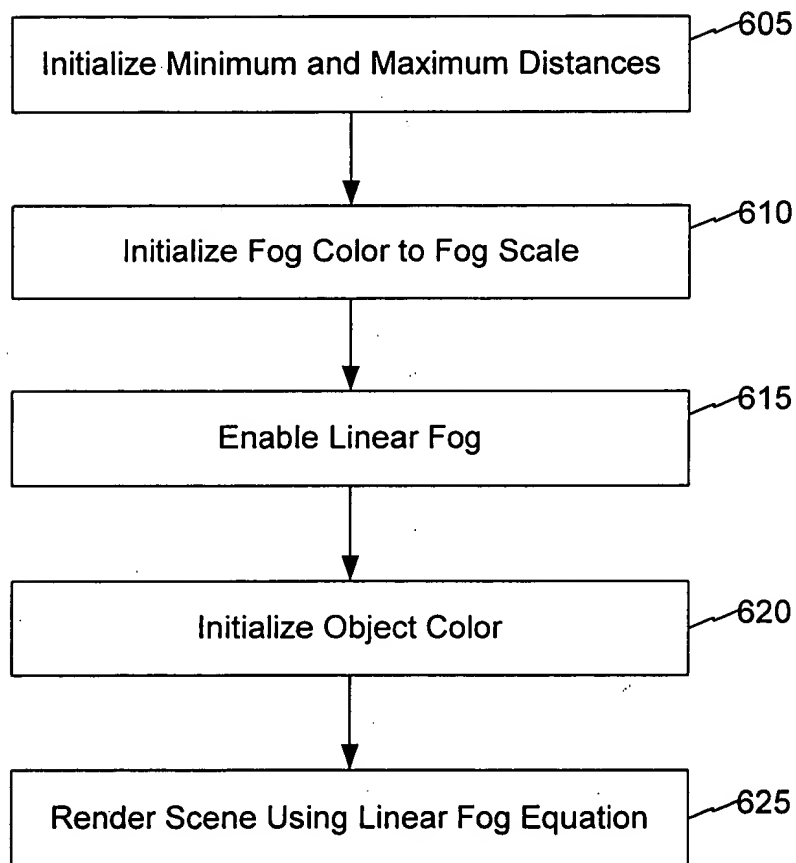


FIG. 6

Linear Fog Equation

Equation One (1)

$$\text{Attenuation Factor}(f) = \frac{\text{Maximum Distance} - \text{Pixel Distance}}{\text{Maximum Distance} - \text{Minimum Distance}}$$

Equation Two (2)

$$\text{Color} = f \cdot \text{Object Color} + (1-f) \cdot \text{Fog Color}$$

Equation Three (3)

$$\text{Color} = \frac{\text{Pixel Distance} - \text{Minimum Distance}}{\text{Maximum Distance} - \text{Minimum Distance}} \cdot \text{Fog Scale}$$

FIG. 7

09990085.112101

Reset Pixel Colors Located Outside the Fog Region

800

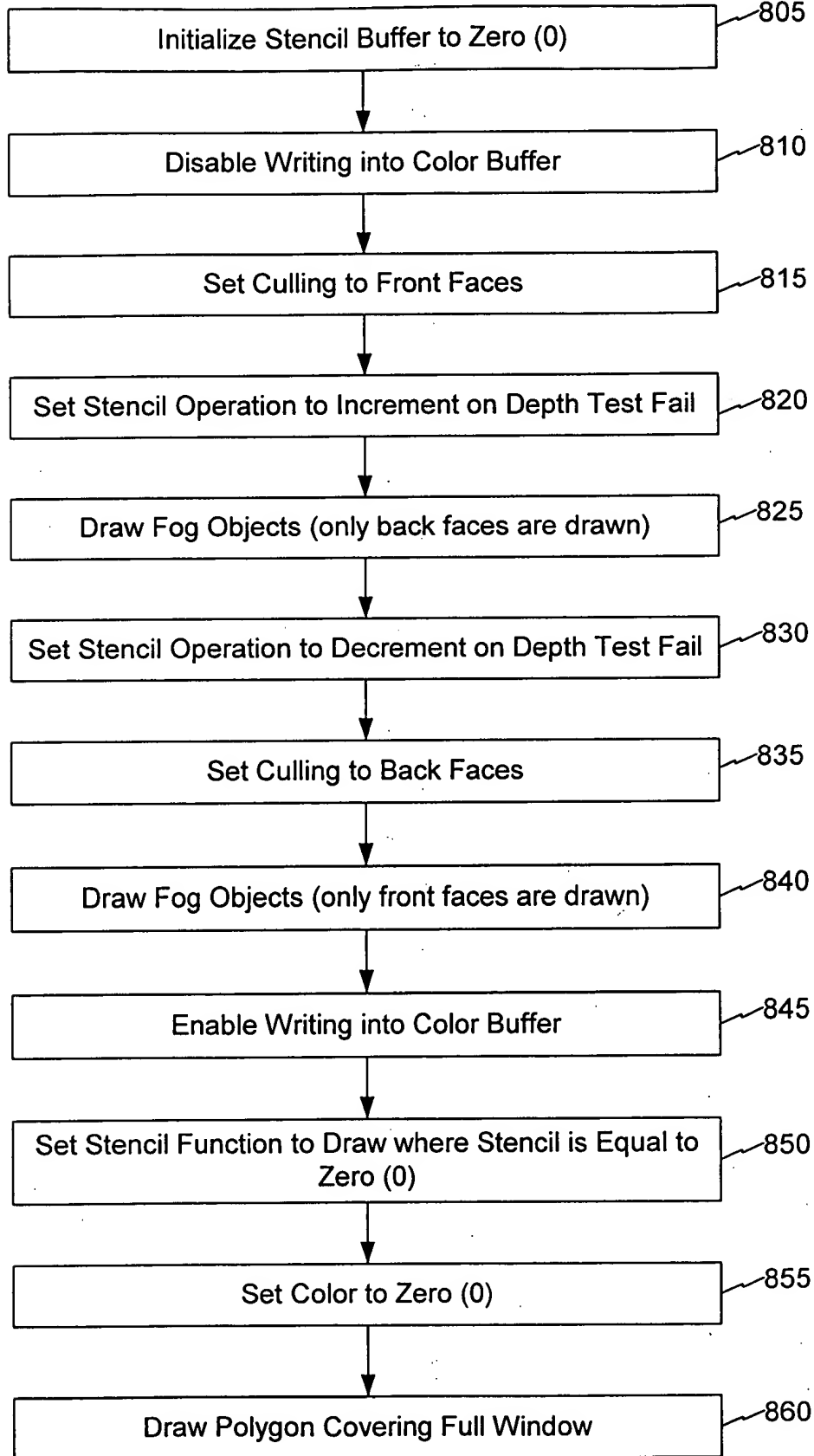


FIG. 8

0990035 112101

**Determine Travel Distance through Fog Region
from Reference Point to Pixel**

900

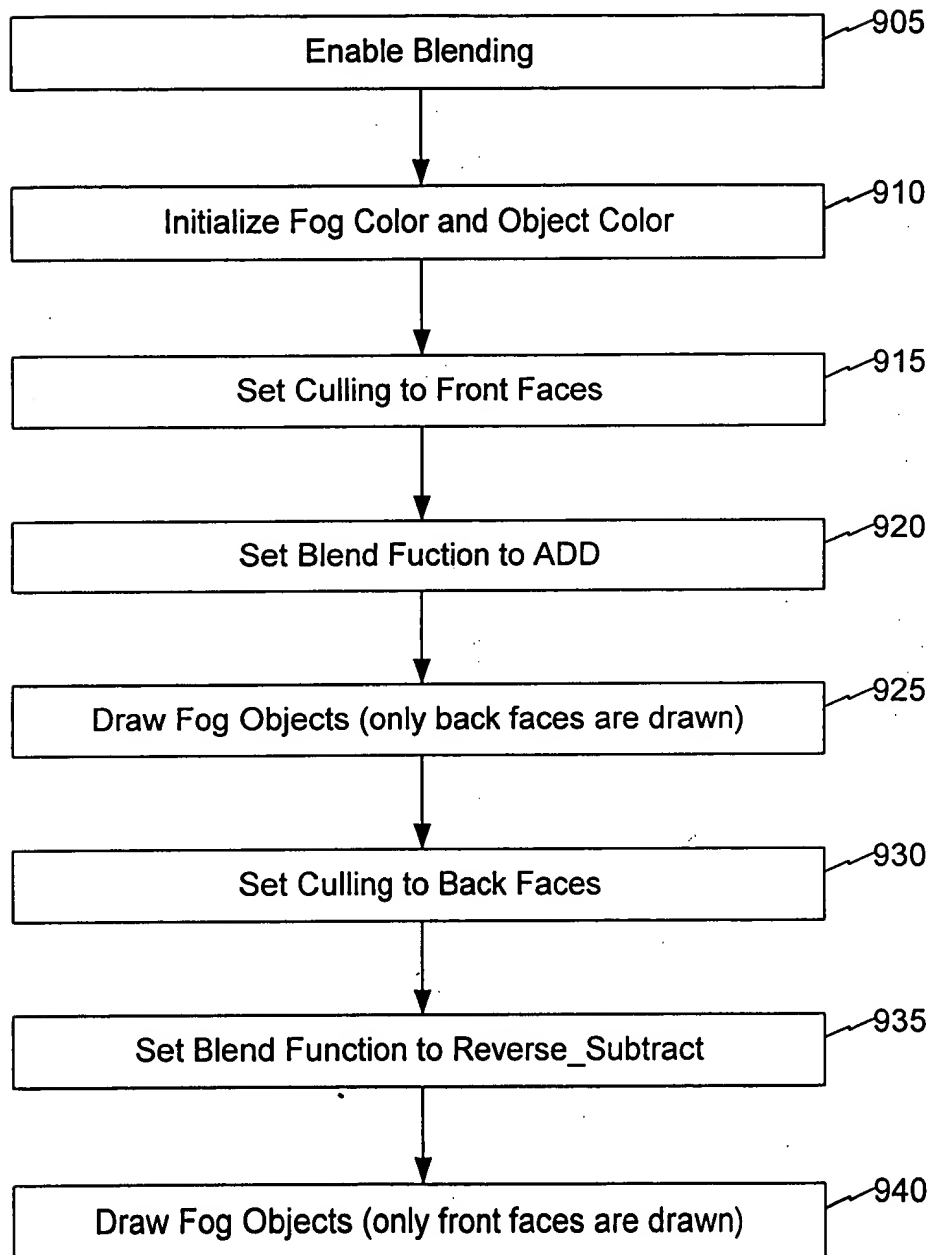


FIG. 9

Render Scene Based on Fog Factor

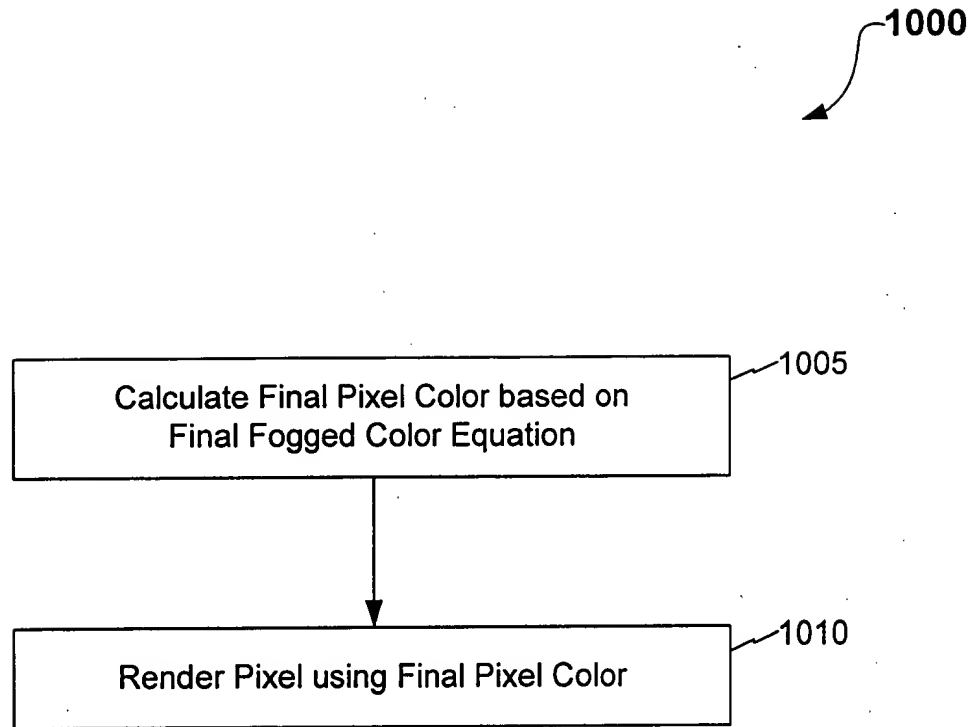


FIG. 10

Final Fogged Color Equation

Unfogged pixel color • fog factor + fog color • (1 - fog factor)

FIG. 11

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**Render Scene Based
on Fog Factor**

1200

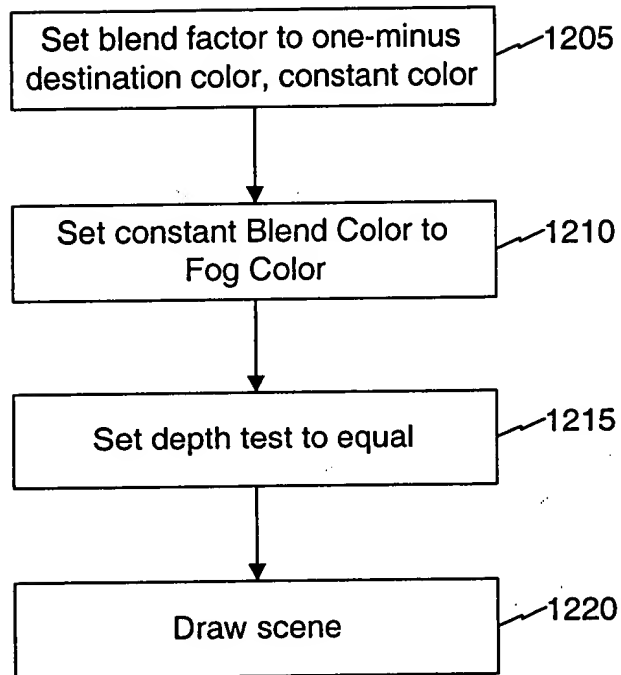


FIG. 12

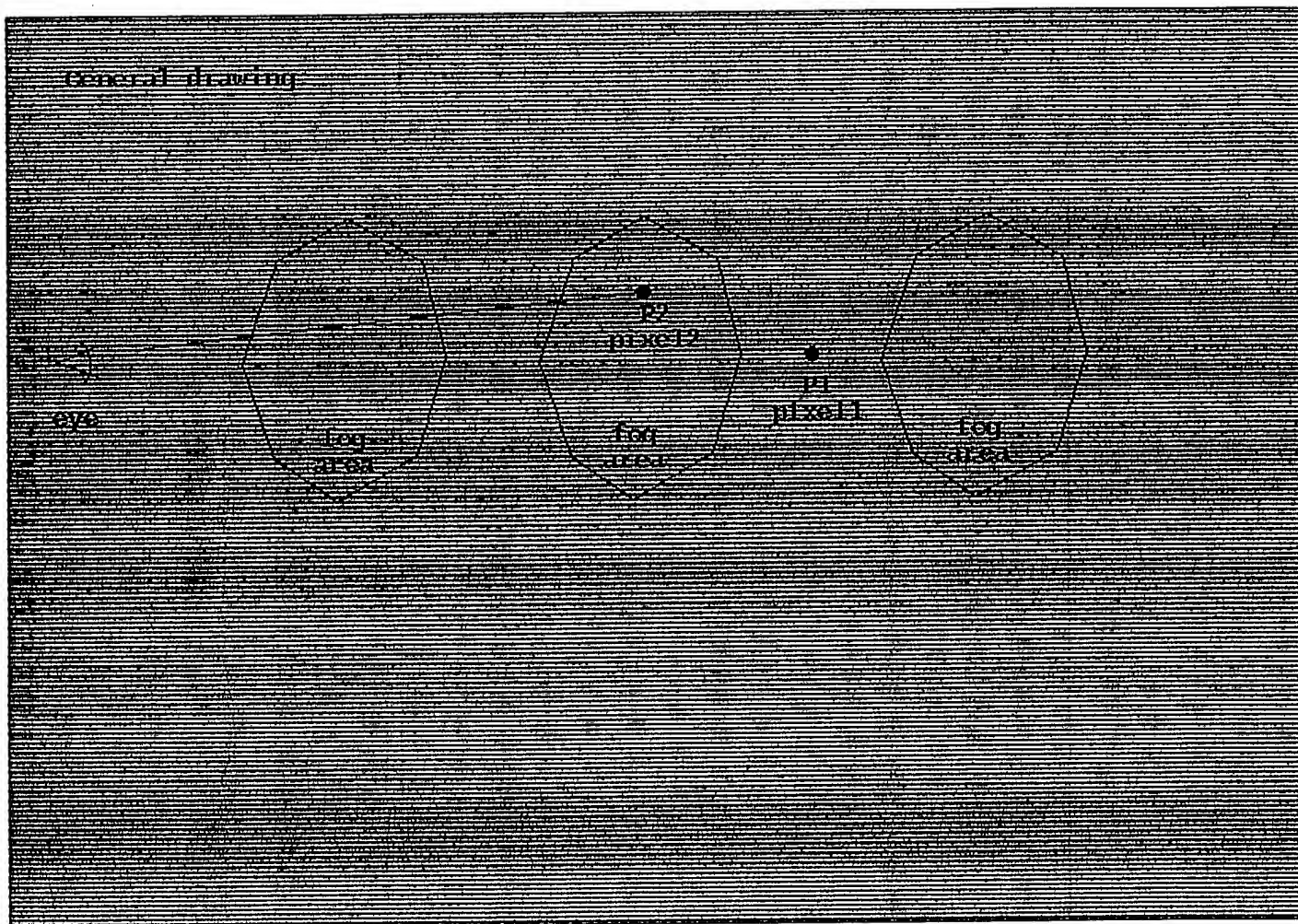


FIG. 13A

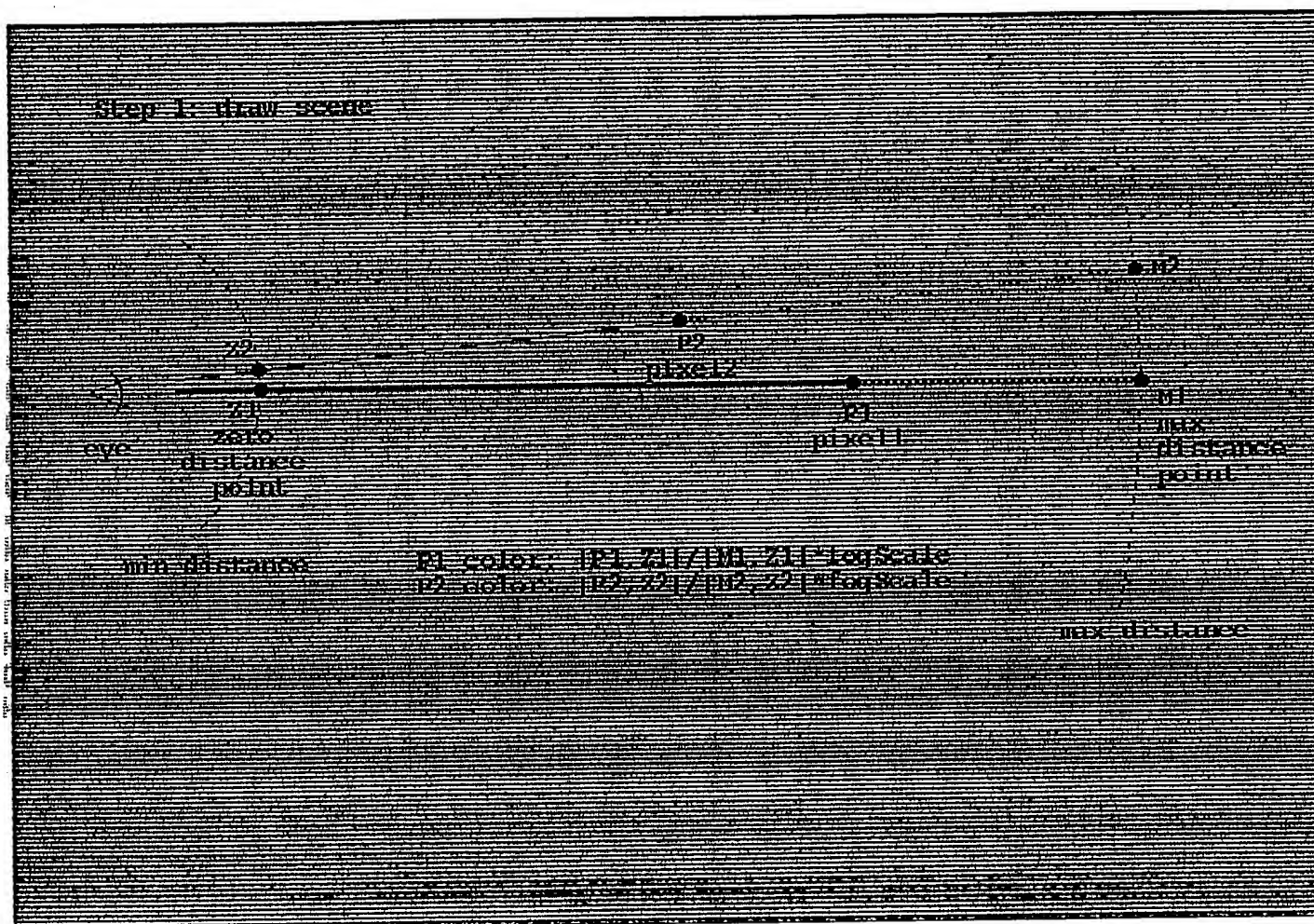


FIG. 13B

Diagram illustrating the stencil buffer operations for drawing log objects. The diagram shows three overlapping polygons representing log areas. A horizontal line passes through them, with points P1 and P2 marked. The diagram illustrates the sequence of operations: 'add to stencil' at P2, 'subtract stencil' at P1, and 'add to stencil' at P1.

P1 stencil value: 1 1 0 → color 0
P2 stencil value: 1 1 1 → keep color $[P2, Z2] / [P2, Z2] * \text{logScale}$

```
P1_stencil|value: 1 1 0 2 color 0
P2_stencil|value: 1 1 1 1 5 loop color [P2, Z2]/[M2, Z2]*logScale
```

FIG. 13C

Diagram illustrating the rendering of fog objects in a 3D scene. The scene shows three overlapping fog volumes (octagons). An 'eye' is positioned on the left. Key points and distances are marked:

- zero point**: The origin of the coordinate system.
- near distance**: The distance from the eye to the left edge of the fog volume.
- max distance point**: The distance from the eye to the right edge of the fog volume.
- fog area**: The interior of the fog volume.
- P1, P2, P3, P4**: Points on the boundaries of the fog volumes.
- pixel1, pixel2**: Points on the horizontal axis within the fog volumes.

The diagram illustrates the calculation of fog color for a given point (P1 or P2) based on its distance from the eye and the fog volume boundaries.

P1 color:

$$0$$

$$\frac{(|P1, Z1|/|P1, Z1| * fogScale)}{(|P2, Z1|/|P1, Z1| * fogScale)}$$

$$\frac{(|P3, Z1|/|P1, Z1| * fogScale)}{(|P2, Z1|/|P1, Z1| * fogScale)}$$

$$(|P2, Z1| * |P3, Z1|) / (|P1, Z1| * fogScale)$$

P2 color:

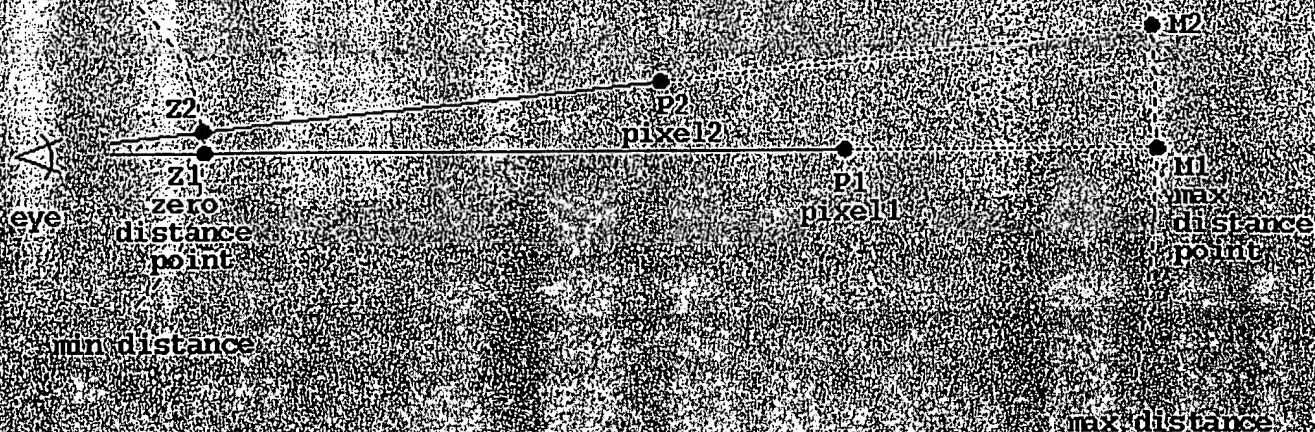
$$(|P2, Z2|/|P2, Z2| * fogScale)$$

$$\frac{(|P1, Z2|/|P2, Z2| * fogScale)}{(|P3, Z2|/|P2, Z2| * fogScale)}$$

$$\frac{(|P1, Z2|/|P2, Z2| * fogScale)}{(|P3, Z2|/|P2, Z2| * fogScale)}$$

$$(|P1, Z2| * |P3, Z2|) / (|P2, Z2| * fogScale)$$

Step 4: convert pixel values



$P1_color: P1_color - fogDensity/fogScale * ||M1 - Z1||$
 $P2_color: P2_color - fogDensity/fogScale * ||M2 - Z2||$ note $||M1 - Z1|| = ||M2 - Z2||$
 (linear fog)

or

$P1_color: pixelmap[P1_color/fogScale * ||M1 - Z1||]$
 $P2_color: pixelmap[P2_color/fogScale * ||M2 - Z2||]$
 (exp or exp2 fog)

FIG. 13E

0990085 112101

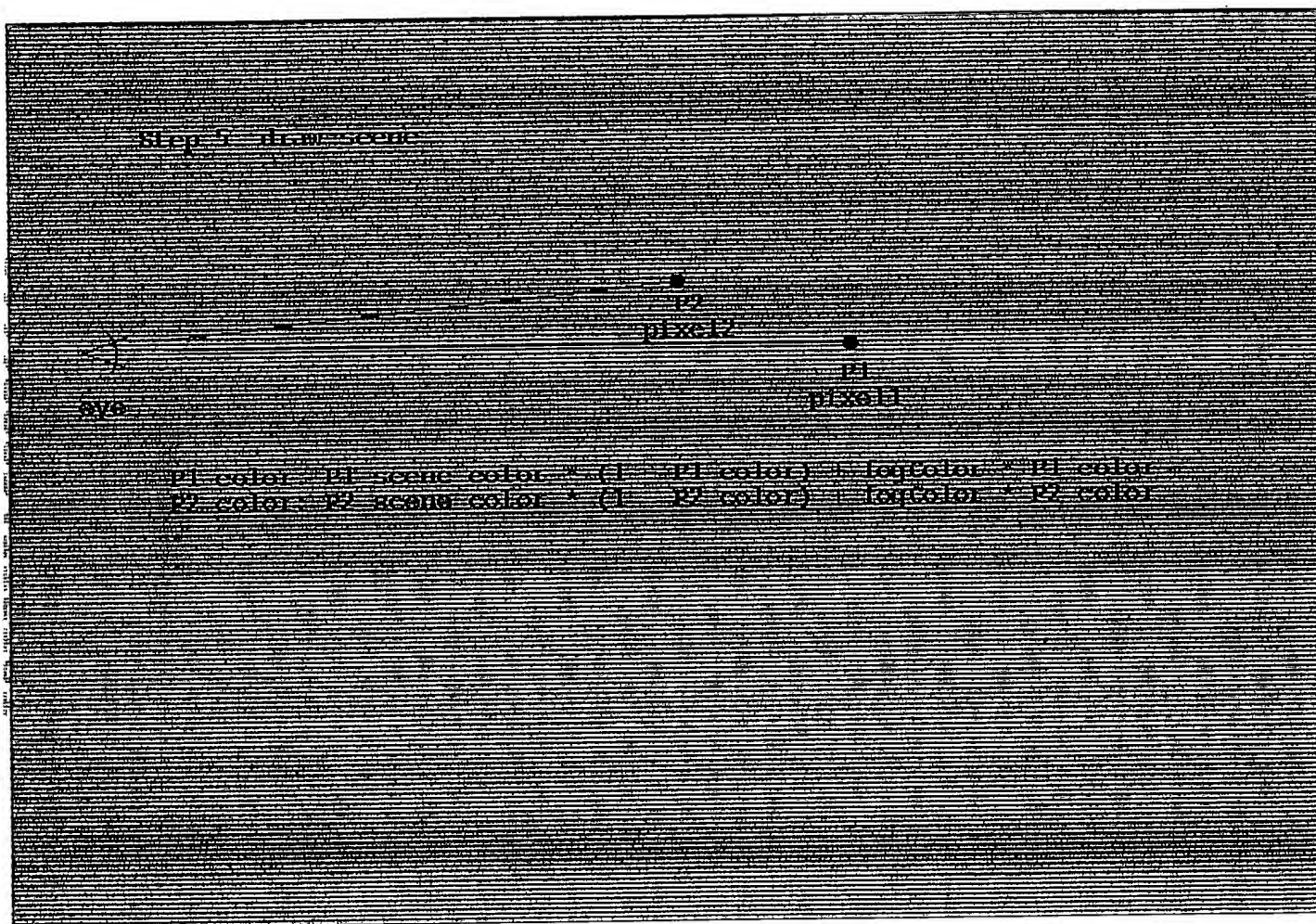


FIG. 13F

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